Prev Sci (2018) 19:507–515
DOI 10.1007/s11121-017-0824-y

Longitudinal Predictors of Behavioral Intentions and HIV Service Use Among Men Who Have Sex with Men

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Published online: 18 July 2017

Abstract HIV prevention interventions are generally effective at reducing sexual risk. Although these interventions have been widely disseminated in the USA, their success depends largely on whether subpopulations who have been prioritized for risk reduction are willing to participate. Understanding the factors predicting service utilization is critical to maximizing public health benefit. HIV-negative men who have sex with men (MSM) (n = 613) were enrolled in a longitudinal study investigating whether theoretically derived psychosocial variables (past behavior, cues to action, perceived susceptibility, positive expectations, perceived barriers, personal discomfort, and recent condomless anal intercourse) predicted intentions to use HIV prevention services and service use behavior across multiple categories (information seeking, structured service use, HIV testing, and volunteering/working in prevention services). Cues to action (including life events such as friend's recent HIV diagnosis) and past service use emerged as the most consistent predictors of intentions and actual service use. Perceived susceptibility, positive expectations, and condomless anal intercourse predicted some categories of service use indirectly through intentions. Contrary to predictions, perceived barriers and personal discomfort predicted intentions but were not predictors of service use. Intentions generally predicted behavior, with the exception of structured service use. This study addressed methodological limitations of prior research and utilized data from a longitudinal sample of MSM to discover predictors of access to HIV prevention services. Understanding who accesses HIV services and why will allow for directed strategies to improve dissemination and utilization.

Keywords Health behavior · Prevention interventions · MSM · Intentions · HIV/aids

In the USA, it is estimated that approximately 40,000 people become infected with HIV annually, and men who have sex with men (MSM) are disproportionately represented (CDC 2015). The Centers for Disease Control and Prevention estimates that 67% of all new HIV infections in the USA in 2015 were accounted for by sexual contact between MSM. Although other categories of transmission have decreased in recent years, rates of new infections among MSM have remained stable.

Research has focused on developing interventions to prevent HIV transmission and evaluating their effectiveness. These interventions have focused on "behavioral" strategies (e.g., increasing condom use) to reduce sexual risk behavior, "treatment as prevention" strategies to increase HIV testing and initiate treatment, and more recent "biomedical" strategies (e.g., pre-exposure prophylaxis or PrEP) to prevent transmission (Sullivan et al. 2012). Many of the developed interventions are effective for HIV prevention, including those services tailored to MSM. For the first time in history, researchers in the field recognize that it is possible to end the HIV epidemic with effective combinations of preventive interventions (Padian et al. 2011).

Although significant research attention has focused on developing and testing preventive interventions, these programs

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will only be successful at reducing rates of HIV transmission nationally if subpopulations at high risk for HIV transmission, such as MSM, are willing to participate. Even though prevention services are increasingly available, they are not always accessed (Sullivan et al. 2012). Indeed, research suggests that the highest-risk groups may be least likely to access services (Earl et al. 2009; Noguchi et al. 2007). Despite effective interventions, there has been a lack of research on which individuals actually access these services and what variables predict their engagement. Understanding who is reached and the factors predicting utilization of HIV services is critical to maximizing intervention effectiveness.

The research currently available suggests components of the interventions themselves that promote enrollment and retention. A meta-analysis on this topic revealed that men are most likely to begin and complete intervention programs that are shorter, based on work and hospital settings, include financial incentives, and involve HIV testing and condom provision (Durantini and Albarracin 2009). Additional studies have shown that culturally relevant appeals tailored to individual participants promote enrollment in HIV prevention counseling (Wilson et al. 2013).

Still, other research focuses on personal characteristics with regard to initiation and completion of HIV interventions. A meta-analysis on this topic revealed that individuals who were already using condoms consistently were more likely to enroll than those who were not (Noguchi et al. 2007). This finding unfortunately suggests that the individuals at highest risk of transmission are less likely to access services. Participants most likely to complete HIV prevention programs were those with less knowledge about HIV, average motivation, and average prior condom use. Additionally, intervention studies with a greater percentage of women, ethnic minorities, or higher-risk individuals had the lowest rates of retention in interventions. A more recent study similarly found that participants most likely to accept HIV prevention counseling were those who were very motivated to use condoms, reported acquiring skills relevant to condom use, and already used condoms consistently (Earl et al. 2009). The perception that the intervention would be helpful explained the associations of these variables with participation in counseling. This research further suggests that lower-risk groups are most likely to accept services. Finally, a non-probability study showed that recent physical health complaints among men predicted engagement in HIV risk reduction counseling (Durantini and Albarracin 2012).

Of the limited studies available, few have examined predictors of HIV service use among MSM. Therefore, generalizations to this specific group, which has been prioritized in the current HIV prevention landscape, are questionable. And most of the research reviewed has not systematically controlled for prior HIV service use, as is the norm in classic longitudinal analytic procedures given that this increases the strength of claims about direction of effects (Fitzmaurice et al. 2009).

The theoretical and empirical literatures relevant to HIV preventive interventions document a large and robust association between behavioral intentions and subsequent behavior (e.g., Albarracin et al. 2001, 2003, 2005; Becker 1974; Catania et al. 1990; Fishbein and Ajzen 1975; Fisher et al. 2003; Janssen et al. 2001). A working group of experts in health behavior theory convened by the National Institute of Mental Health (NIMH) similarly concluded that intentions are an important transtheoretical construct for understanding health behaviors. The report described intentions as a "necessary" variable in models and the one that is "most proximal to behavior" (Fishbein et al. 2001). These theorists characterized other constructs, such as positive and negative attitudes, perceived susceptibility, negative emotions related to the behavior, and cues to action as "important first step(s)" in health behavior change, or direct predictors of intentions and indirect predictors of behavior. Although many studies have examined the role of intentions in predicting future condom use, extant research hoping to understand decisions about accessing HIV prevention services has not, perhaps to the field's detriment given the centrality of intentions to health behaviors.

The present study aimed to address gaps in the existing literature on HIV prevention service utilization, especially among MSM. Specifically, we employed a longitudinal design to test a theoretically informed model of why MSM participate in a variety of HIV prevention services (see Fig. 1). We first determined which service-relevant psychosocial variables (risk status, personal discomfort with service use, positive expectations, perceived barriers, cues to action, and perceived susceptibility) predict whether or not MSM intend to participate in HIV prevention services across a variety of levels (information seeking, structured service use, HIV counseling and testing, and volunteering), while controlling for demographic characteristics (age, ethnicity, education, income, and distance lived from the neighborhood where services are concentrated). Second, we evaluated the longitudinal association between intentions to access each level of service use and subsequent behavior. Finally, the longitudinal indirect effect of the service-relevant psychosocial variables on each level of service use through behavioral intentions was examined. This study is the first to comprehensively examine these questions in a prospective sample of MSM.

Method

Participants and Procedure

The current study was conducted in Central Arizona on the experiences of MSM in relation to HIV service use,

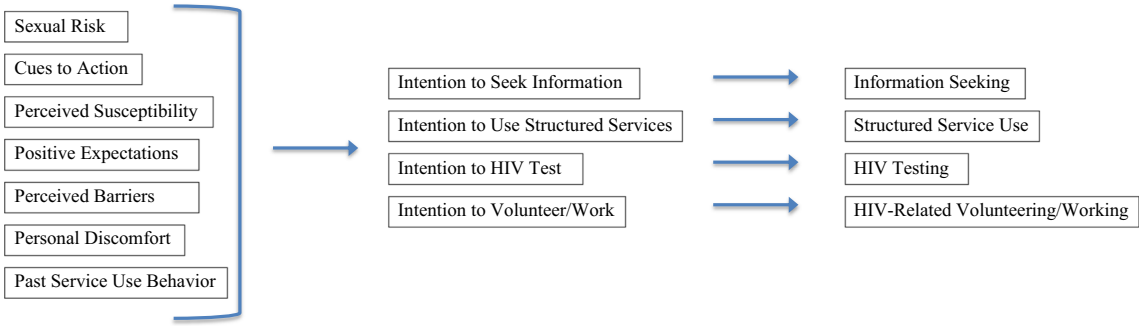

Fig. 1 Conceptual model of HIV prevention service utilization

perceptions, access, and risk behavior. Efforts were made to recruit a diverse sample of men with respect to age, ethnicity, education, income, and HIV status. Participants were recruited through community and media advertisements, direct distribution of the survey in gay-related venues, and snowballing methodology. Men completed the survey using a paper questionnaire, over the phone, or on the Internet, and were compensated $25 for their participation. Further details on recruitment strategies and methods are reported elsewhere (citation removed for masked review). In total, 709 men participated in the larger investigation. Participants were eligible for the study if they were at least 18 years old and reported living in the surrounding area at least 3 months of the year. Men were eligible if they either reported sexual contact with another man in the past year or identified as gay or bisexual.

Ninety-one percent of men (n = 647) agreed to provide contact information and were mailed a follow-up survey approximately 6 months after completing the initial survey. The follow-up survey was completed and returned by 62% (n = 399) of the men who were mailed a survey. Data were imputed for men who failed to provide data at follow-up (see "Analysis" section). Participants were 75% White, 14% Latino, 5% African American, 4% Native American, and 2% Asian American. Participants ranged in age from 18 to 72 (M = 35.71, SD = 11.52). Forty-one percent had at least a college education, and the modal personal income fell between $25,000 and $35,000.

Measures

Prior to conducting our quantitative instrument, we conducted focus groups and interviews with MSM and service providers with the aim of identifying (a) the types of services available to MSM in the study region and (b) the factors that might predict their participation in those services. This formative work served as the foundation for building several of the measures in our quantitative instrument described below.

Socio-Demographic Covariates Participants self-reported their age, ethnicity, highest level of education, and annual income at baseline. Because of the ethnic distribution of the sample, participants were categorized as ethnic minority (coded 0) or white (coded 1). Using geographic information systems, we calculated the distance each participant lived (based on their self-reported nearest cross streets) from the "gay corridor" where most HIV-related service providers were concentrated.

Predictor Psychosocial Variables

Condomless Anal Intercourse Participants were asked detailed questions at baseline about their sexual behavior in the past 6 months. Based on these responses, we created a variable reflecting whether the participant had participated in any vs. no condomless anal intercourse (CAI) with a self described "casual" partner, or with a "steady" partner who was non-monogamous or from a relationship of less than 6-month duration (reasoning that these were steady partners whose HIV status would be difficult to definitively know). Participants who engaged in CAI with a monogamous steady partner of more than 6-month duration were not counted in the CAI group.

Personal Discomfort with HIV Service Use Drawing from our formative interviews, we derived a measure to assess the degree to which the characteristics of HIV prevention services were troublesome to participants. Participants were asked the following questions: "How much would you be bothered by…" followed by seven possible difficult characteristics of HIV prevention services (e.g., "…talking with a stranger about HIV/AIDS in general?" or "…being seen going into an office of an HIV prevention organization?"). The answer choices ranged from 1 ("Not at all bothered") to 5 ("Extremely bothered"). The mean score was calculated from the responses to each of the seven items to form a scale. Cronbach's alpha for this measure was .82.

Positive Expectations About HIV Service Use Drawing from our formative interviews, we developed a measure to assess the extent to which participants expected that their experiences at HIV prevention organizations would be positive. Participants were asked the following questions: "If you were

to use HIV prevention services (like getting tested for HIV or going to a discussion group about HIV), do you think that…" followed by five items indicating positive expectations about accessing HIV services (e.g., "…You would get accurate information?" or "…The staff would respect you?"). The answer choices ranged from 1 ("Definitely not") to 5 ("Definitely yes"). The scale was computed as the mean of item responses. Cronbach's alpha for positive expectations was .73.

Barriers to Service Use Three items indicating potential barriers to service use (e.g., "…Information about you would be spread to others?" or "…Your health insurance would be affected?") were administered using the same scale as the positive expectations measure. Cronbach's alpha was not computed due to the diversity of items included in this measure that assessed an accumulation of different experiences rather than a unified construct (Kline 1999).

Cues to Action The Health Belief Model (Janz and Becker 1984) suggests that specific motivating events in one's life (or "cues to action") prompt individuals to engage in a variety of health behaviors. Participants were asked whether or not (yes or no) they experienced six of the most common events in the past 6 months. Consistent with the conceptualization of this construct from the Health Belief Model, these items included internal cues (e.g., "…felt sick a lot or got sick in a way that made you wonder about HIV?") and external cues (e.g., "…had someone close to you who found out they had HIV or who died of AIDS?"). The sum number of events reported was then calculated and used in analyses.

Perceived Susceptibility Based on prior measures developed for use in MSM (e.g., Aspinwall et al. 1991; Joseph et al. 1987), participants were asked three questions assessing their perceived susceptibility or vulnerability to contracting HIV (e.g., "Considering all of the different factors that may contribute to HIV, including your own past and present behavior, how likely would you be to get HIV?"). Response options ranged from 1 ("Very unlikely") to 5 ("Very likely"). The scale was computed as the mean of item responses. Cronbach's alpha for this measure was .82.

Criterion Variables Assessing Service Use Through our formative research, we derived four categories (or "levels") of HIV prevention service use, with the lowest level reflecting the least required for participation and higher levels reflecting successively greater amounts of engagement. For each category, participants responded to a list of one or more specific activities, indicating whether or not they had engaged in the activity ever (for the baseline assessment) and in the past 6 months (for the follow-up assessment). The number of activities participants reported engaging in was then summed within each category to create a score for that category. Information seeking: This represented the first category of service use, reflecting utilization of HIV prevention solely as a means of gathering information. Examples of the five information seeking items included "Have you used the Internet to get information about HIV/AIDS?" or "Have you asked a friend or doctor about HIV/AIDS?". HIV testing: Participants were asked "When was the last time you were tested for HIV?" At baseline, responses were categorized as either never tested (coded 0) or ever obtained an HIV test (coded 1). At follow-up, responses were categorized as either never tested or tested more than 6 months ago (coded 0) or obtained an HIV test within the last 6 months since baseline (coded 1). Structured service use: Participants were asked three questions related to attending structured group activities or scheduled individual sessions related to HIV prevention (e.g., "Have you attended an HIV-related support group or skills-building workshop where men get together and talk about protecting themselves from HIV?"). Volunteering and working in HIV prevention: Although volunteering is not traditionally considered an activity that reduces risk, there are a number of prevention interventions that rely heavily on volunteers (Hayes et al. 2003; NIMH HIV/STD Prevention Trial Group 2010). Participants were asked, "How often have you worked or volunteered for HIV/AIDS service organizations?" Participants were categorized according to whether they had not (coded 0) or had (coded 1) worked or volunteered in a capacity related to HIV.

Mediator Intention Variables To assess men's intentions to engage in all of the services described above, participants were asked the following question at baseline: "In the next six months, how likely is it that you will try to…" followed by items corresponding to each of the categories of service use analyzed in this paper: information seeking ("…seek out more information about HIV?"), HIV testing ("…get tested for HIV?"), structured service use ("…attend a support group or workshop about HIV?" and "…go to an HIV prevention service organization to talk to someone about HIV?"), and volunteering and working ("…volunteer or get a job at an HIV prevention organization"). The answer choices ranged from 1 ("Not at all likely") to 5 ("Extremely likely"). Previous research demonstrates that similarly worded items have good predictive validity with subsequent behavior (Armitage and Conner 2001) and that use of a continuous response scale measuring strength of behavioral intentions is superior to dichotomous, forced-choice responses (e.g., Flannelly et al. 2000).

Analysis

To handle missing data from the longitudinal study design, multiple imputation was conducted using NORM version

2.02. Based on the number of iterations required for the EM algorithm to converge, 5000 iterations were used for each of the five imputed datasets. To stabilize the solution, two ridge priors were used in the imputation process. Results are based on the pooled data analyses. Scales and interaction terms were computed prior to imputation and then re-calculated after imputing missing data. Research has documented that multiple imputation outperforms traditional methods for handling missing data even with high attrition or small sample sizes (Graham 2009). Imputation procedures followed standard best practice recommendations.

Analyses for the current study were run on 613 men who had not received an HIV-positive test result (and either believed themselves to be HIV-negative or had received an HIV-negative result at their last test). Among this final sample, those who did not complete the follow-up survey (and for whom data were imputed) differed from those who completed both time points in that they were younger, had lower income and education, and were less likely to identify as white. These demographic variables were included as covariates in all analyses.

For analyses in which a continuous variable was entered as the outcome (information seeking, structured service use), separate ordinary least square regressions were used. For all analyses in which a dichotomous variable was entered as the outcome (HIV testing, volunteering, and working), separate binary logistic regressions were used. Demographic characteristics, risk variables, and—importantly—prior service use reported at baseline were entered as covariates in all analyses predicting service use reported at follow-up for each type of service use. To test hypotheses about the indirect effects of predictors on service use via intentions, indirect effects were estimated utilizing standard bootstrapping procedures (Hayes 2013), again accounting for covariates consistent across all analyses.

Results

In bivariate analyses, participants who were younger, lower-income, or reported recent cues to action were most likely to seek information about HIV between baseline and follow-up. Those who were younger or reported recent cues to action were also more likely to use structured services. Table 1 shows bivariate correlations between sociodemographic, psychosocial predictor variables, and service use criterion variables in the study.

Table 2 presents the results of models predicting each type of service use. The "A Path" in Table 2 represents the results of the first study aim (testing whether the service-relevant psychosocial variables predict intentions for each level of service use). MSM who endorsed recent cues to action and with highly perceived susceptibility to HIV had stronger intentions to seek information about HIV, access structured services, and obtain an HIV test. Men with positive expectations about HIV services had stronger intentions to seek information, access structured services, and volunteer or work in HIV services. Those who perceived barriers to HIV service use had weaker

Table 1 Descriptives and bivariate correlation matrix

	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age	34.78	11.39														
2. Ethnicity	.71	.45	*.26*													
3. Education	3.38	.96	*.31*	*.13*												
4. Income	4.46	2.32	*.36*	*.21*	*.40*											
5. Distance	9.55	11.29	−.05	*−.12*	*−.09*	*−.10*										
6. Condomless anal	.47	.50	*−.13*	*−.08*	*−.08*	−.02	.004									
7. Discomfort	1.52	.63	*−.09*	−.08	*−.13*	*−.11*	*.09*	.05								
8. Pos expectations	3.73	.63	−.03	−.05	*−.08*	−.03	−.003	.07	*−.29*							
9. Barriers	2.50	.78	−.01	−.04	−.04	−.04	.03	.02	*.27*	*−.15*						
10. Susceptibility	2.15	.87	*−.14*	*−.09*	*−.14*	*−.09*	−.05	*.35*	.05	*.09*	*.11*					
11. Cues to action	1.96	1.47	*−.24*	−.06	*−.10*	*−.14*	−.04	*.22*	.02	.05	*.09*	*.35*				
12. Information seek	1.18	1.17	*−.16*	−.05	−.04	*−.11*	−.01	.03	−.06	.09	−.07	.06	*.14*			
13. HIV testing	.27	.45	.03	−.02	.06	−.01	−.03	.05	.003	−.02	.04	−.05	.03	.12		
14. Structured service	.35	.47	*−.11*	−.05	−.03	−.07	−.05	.01	−.04	−.01	−.07	.05	*.14*	*.28*	.03	
15. Volunteering	.39	.36	−.05	−.03	−.01	.03	−.04	.02	−.04	−.02	−.09	.03	.11	*.20*	.07	*.31*

Note: Values displayed in the first two columns of this table are means and standard deviations for covariates, predictors, and criterion variables. Remaining values in this table are Pearson correlation coefficients for associations between continuous variables, point biserial correlation coefficients for associations between continuous and dichotomous variables, and phi coefficients for associations between dichotomous variables. Statistically significant results (at the $p < .05$ level) are indicated in italics. Ethnicity was coded as 0 = ethnic minority and 1 = white

Table 2 Results of full models, including predictors of intentions, longitudinal association between intentions and behavior, and indirect paths from hypothesized predictors to levels of service use through intentions

Predictors	Information seeking			Structured service use			HIV testing			Volunteering		
	A Path	B Path	AB Path	A Path	B Path	AB Path	A Path	B Path	AB Path	A Path	B Path	AB Path
Condomless anal intercourse	−.110 (.099)	*.180 (.070)*	−.019 (*.018*)	−.065 (*.084*)	.072 (*.044*)	−.005 (*.007*)	*.356 (.119)*	*.330 (.096)*	*.122 (.051)*	.007 (*.940*)	*.337 (.139)*	.001 (*.032*)
Cues to action	*.110 (.035)*		*.020 (.008)*	*.110 (.029)*		.008 (*.005*)	*.217 (.041)*		*.074 (.024)*	.056 (*.032*)		.019 (*.013*)
Perceived susceptibility	*.192 (.058)*		*.078 (.015)*	*.188 (.050)*		.013 (*.008*)	*.229 (.071)*		*.077 (.031)*	.037 (*.056*)		.013 (*.021*)
Positive expectations	*.363 (.076)*		*.068 (.028)*	*.330 (.066)*		.024 (*.013*)	.141 (*.094*)		.048 (*.038*)	*.276 (.073)*		.097 (*.042*)
Perceived barriers	−.024 (*.061*)		−.004 (*.012*)	.031 (*.052*)		.002 (*.005*)	*−.169 (.074)*		−.057 (*.028*)	−.019 (*.058*)		−.007 (*.023*)
Personal discomfort	−.017 (*.079*)		−.004 (*.017*)	*−.136 (.067)*		−.009 (*.006*)	−.170 (*.094*)		−.056 (*.034*)	*−.176 (.074)*		−.062 (*.033*)
Past behavior	*.144 (.030)*		*.026 (.008)*	*.264 (.043)*		.019 (*.011*)	*.765 (.145)*		*.260 (.082)*	*1.199 (.119)*		*.413 (.140)*

Note: Separate models were run using bootstrapping techniques for each level of service use (information seeking, structured service use, HIV testing, and volunteering). All predictors as well as covariates (distance from center of gay community, ethnicity, age, education, and income) were included in all models. The baseline measure for each type of service use was also entered as a covariate in each model (labeled "past behavior"). The "A Path" represents the association between predictors (at baseline) and intentions to use each type of services (at baseline). The "B Path" represents the association between intentions to use each type of service use (at baseline) and actual service use (at follow-up). The "AB Path" represents the indirect path from predictors to each level of service use through intentions. The values in this table are displayed as path coefficient (*standard error*). Statistically significant results (at the $p < .05$ level) are indicated in italics

intentions to obtain an HIV test. MSM who had engaged in recent CAI had stronger intentions to obtain an HIV test. Men who reported emotional discomfort with the idea of accessing services also reported weaker intentions to seek structured services and to volunteer or work in HIV services. Those who had previously sought information about HIV, accessed structured services, obtained an HIV test, and volunteered or worked in HIV services had stronger intentions for each corresponding type of service use.

The "B path" in Table 2 represents the results of the second study aim (testing whether intentions prospectively predict each respective level of service use). Intentions to seek information, obtain an HIV test, and volunteer or work in HIV services all significantly predicted subsequent information seeking, HIV testing, and volunteering/working, respectively. Intentions to seek structured services did not significantly predict structured service use.

Finally, the "AB path" in Table 2 represents the results of the third study aim (testing whether service-relevant psychosocial variables predict each level of service use indirectly through intentions). Past information seeking about HIV, past HIV testing, and past volunteering or working in HIV services significantly predicted the corresponding service-seeking behaviors indirectly through behavioral intentions. Cues to action and perceived susceptibility operated similarly in these models, showing significant indirect effects on both information seeking and HIV testing through intentions to seek information and intentions to obtain an HIV test, respectively. The indirect path from positive expectations to information seeking through behavioral intentions was also significant. Finally, recent CAI significantly predicted HIV testing indirectly through intentions to test. The other indirect paths tested were non-significant.

Discussion

The two variables of interest that most consistently emerged as predictors across bivariate and multivariable models were past behavior (i.e., prior use of each type of service) and cues to action (i.e., events triggering service use, such as feeling sick or learning a friend was diagnosed with HIV). Past service use of each type was positively related to intentions to use that type of service, and via intentions, past service use also indirectly predicted future information seeking, HIV testing, and volunteering or working in an HIV service organization. Cues to action were significantly related to intentions to seek information, access structured services, and obtain an HIV test, and via intentions, cues to action indirectly predicted subsequent information seeking and HIV testing. The importance of these variables (past behavior and cues to action) is consistent with prior theoretical research. In an NIMH expert committee report (Fishbein et al. 2001), prominent health behavior theorists

agreed that individuals tend to act in ways consistent with their past behavior until the routine is disrupted by "some internal or external stimulus (e.g., a symptom, a mass media message)" or cue to action (Fishbein et al. 2001). The current study offers empirical support for these theoretical concepts.

Although past behavior and cues to action emerged as the most consistent predictors, other variables of interest also appeared to play a role in determining use of HIV prevention services. Perceived susceptibility to HIV infection and positive expectations about HIV prevention services were not bivariately associated with any of the service use levels, but were important predictors in multivariable models. Both predicted intentions, and then certain behaviors indirectly through intentions (see "Results" and Table 2 for specifics). These findings are also consistent with health behavior theories, which have characterized variables like susceptibility and attitudes toward services as "important first step(s)" in health behavior change but not necessarily direct predictors of behavior (Fishbein et al. 2001). Although these variables likely contribute to the decision to use services, they may not be sufficient to independently prompt action in individuals who do not otherwise intend to use services.

Inconsistent with theoretical predictions, perceived barriers to service use and personal discomfort did not operate as expected in full models. Although MSM who reported barriers had weaker intentions to obtain an HIV test, and those who reported emotional discomfort with the idea of accessing services reported weaker intentions to seek structured services and to volunteer or work in HIV services, these variables did not predict subsequent service use either directly or indirectly. Both of these constructs represent negative attitudes and emotions about service use. Although negative thoughts and feelings might affect other reported intentions, they do not appear to drive HIV prevention service use (actual behavior). In our sample, it appeared that cues to action was a far more relevant predictor in terms of actual service use behavior than either barriers or discomfort; thus, it is possible that the power of experiencing recent life events relevant to HIV overrides any effect that barriers to accessing services may typically have in association with service use behavior (as opposed to intentions). Additional research is needed to replicate these findings and to explain why certain theoretically derived variables are more powerful predictors than others.

Another finding inconsistent with prior research in this area is that CAI did not predict any of the levels of service use bivariately and predicted HIV testing in a positive direction indirectly through intentions to test. With respect to HIV testing, this finding is consistent with a recent study (Johnson et al. 2016), which found that MSM who had recent CAI were more likely than those with no CAI to complete at-home HIV testing. It is logical that men who have recently engaged in an HIV-related risk behavior would seek testing to determine their HIV status. Indeed, at various points in the epidemic, some testing programs have even screened participants for recent histories of condomless sex and endeavored to preserve resources by only offering free testing to those with recent risk behavior. With respect to other forms of service utilization, past research, including a meta-analysis on the topic (Noguchi et al. 2007), found that the highest-risk individuals are those least likely to access services, a concerning but important phenomenon. While this is inconsistent with our null findings, it is important to note that previous studies have been mostly cross-sectional in design and, even when longitudinal, have seldom included past service use in their models (as is the standard in longitudinal analyses). It may be the case that sexual risk is inversely correlated with service use, but third variables (e.g., health motivation, knowledge of services, and conscientiousness) truly account for the association by decreasing condomless sex and increasing interest in prevention services. Longitudinal investigations that control for past service use, such as the present study, are best suited for understanding these effects. Thus, additional longitudinal research should further explore the associations of HIV-related risk behaviors with service utilization. Understanding the true nature of this phenomenon is critical given the suggestion from previous work that MSM with the highest sexual risk may be the least likely to use HIV prevention services.

A robust finding in the research literature is that behavioral intentions are strong and reliable predictors of behavior. The results of the current study are largely consistent with this idea. Intentions to utilize almost all types of services were associated with subsequent service use of each type, with the exception of structured service use. As a result, none of the indirect effects tested were significant in predicting structured service use through intentions. Although data from the current study cannot empirically test why intentions would not predict behavior for this type of service use, it is possible that the other types of service use assessed (information seeking, HIV testing, and volunteering) were more readily accessible or predictable than structured service use. When asked the question "How likely is it that you will go to an HIV prevention service organization to talk to someone about HIV?" or "…try to attend a support group or workshop about HIV?", men might have been interested, but then encountered greater barriers to actually accessing those structured services, relative to other types of service. For example, educational groups are likely offered relatively less frequently than are other types of services, such as HIV testing, and require greater advanced planning than searching for information independently online. Nevertheless, these findings may provide some comfort to researchers who rely on self-report questionnaires, in that self-reported intentions to use HIV prevention services strongly predict future service use, at least in three out of the four kinds of services we measured.

The findings of the present study must be qualified by a number of limitations. As with all studies utilizing non-

probability sampling designs, making broad assumptions about all MSM based on these findings is not advised. The demographic characteristics of this sample were consistent with those of the surrounding recruitment area. However, it is possible that these MSM were more highly integrated within the gay community (and possibly had greater exposure to HIV information and services) than the overall population, given the venues through which recruitment occurred. Similarly, caution should be used in attempting to generalize these results to other at-risk populations or other types of service use. The use of self-report measures is common in this area of research and often necessary to reduce respondent burden, but nonetheless may represent a limitation compared to objective assessment of service use. Although research has found that HIV testing measured via self-report tends to be quite accurate when compared to medical records (e.g., Fisher et al. 2007), future research would benefit from more objective outcome measurement to confirm access to HIV services and reduce social desirability bias. The use of several measures developed by the authors is likewise a limitation of this study as the scales have not been formally psychometrically validated. However, this approach of formative research through focus groups with MSM and interviews with local leaders of CBOs to develop relevant scales builds on the extant literature by identifying new potential predictors of services which have not been previously studied. Finally, these data were collected prior to the recent push to widely distribute PrEP, and thus, we are unable to evaluate predictors of utilization of this important new HIV prevention technology. Future research should explore whether our findings generalize to use of PrEP and also explore whether there are other, novel predictors of PrEP utilization.

Despite limitations, this study addressed methodological limitations in the existing research literature and utilized data from a longitudinal sample of MSM to examine predictors of using HIV prevention services. Given that effective preventive interventions exist and that they are increasingly accessible to the general public, it is important that research like this study considers which individuals are most likely to accept or use services and what variables predict these decisions. In order to maximize public health benefit, individuals at highest risk must use HIV prevention services. Understanding the *who* and the *why* related to HIV service use will allow for directed strategies to improve dissemination of interventions and utilization of available services.

Overall, this study's findings suggest that HIV interventionists should attend in particular to cues to action, susceptibility, and positive expectations for MSM. For example, HIV prevention service organizations may consider when MSM feel most susceptible to HIV and advertise their services accordingly. Perhaps MSM feel susceptible when starting a new relationship, and so, service organizations might highlight their services on dating sites and apps. Perhaps less obviously, organizations may attract attention with appeals related to when men may be most likely to enter into a new relationship (e.g., "New in town?" or "Just starting at University Y?"). Likewise, if a cue to action is feeling sick, perhaps service organizations should advertise their services in the cold medicine aisle (i.e., one step earlier than doctor's offices). Given the importance of positive expectations found in this study, service organizations should make sure that the services they provide are high-quality experiences. Also, when seeking to attract participants, service organizations might emphasize not just what MSM will "get" with their organization (such as an HIV test result), but how participating in the services will make them feel.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Human Studies All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Grant Support This research was supported by a grant from the Centers for Disease Control and Prevention to the Arizona Department of Health Services through Cooperative Agreement #99004.

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